

## Evaluation of Storage of Seed Stones within Fruit on Germination of Mango (*Mangifera Indica* L.).

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### Abstract:

This experiment was carried out under nursery conditions at Department of Horticulture, University of Khartoum during season 1999-2000. To evaluate storage of mango seed stones within the fruit at two temperature room temperature (28-40 C) and refrigerator (10-12 C) for 4 different duration (2,4,8 and 12 weeks) on germination percentage. The results demonstrated that storage of mango seed stones within fruit had a significant effect on germination percentage and seed stone fresh weight, where storage for 2 weeks had higher germination percentage and higher seed fresh weight compare to 4 weeks. After 8 and 12 weeks seed stone failed to germinate. Storage of seed stones within fruits at room temperature was better than storage in refrigerator with respect to germination percentage but had no significant effect on number of days required for germination. Generally storage of mango seed stone within fruit after 2 weeks is unsuccessful.

**Introduction:** Mango is one of the main fruit crop in tropical region. The leading mango production in the world are India, China, Mexico and Thailand (FAO 2003). Mango cultivation in the world is expanding due to the popularity of this fruit and ever increasing demand for fresh and processed mango products. The importance of seed storage has been recognized ever since humans began to domesticate plants. The duration of successful storage depends upon both the objectives and the species concerned Hong and Ellis (1996). The storage facilities to be provided must be related to the amount of seeds and the period over which they are to be stored. Mango (*Mangifera indica* L) classified as Recalcitrant (Singh, 1968). They are examples of what Roberts (1973) have termed recalcitrant or desiccation-sensitive seeds. Rekha *et. al.*, (2009) explained that recalcitrant seeds are desiccation and chilling sensitive and are viable for a very short period. When fresh recalcitrant seeds begin to dry, viability is first slightly reduced as moisture is lost, but then begins to be reduced considerably at a certain moisture content termed the “critical moisture content” (King and Roberts 1979, 1980a) or “lowest safe moisture content” (Tompsett 1984a). If drying continues further, viability is eventually reduced to zero. In addition Ito and Atubra (1973) reported that seeds remained viable for ten days under dry storage. In contrast both Singh, 1960; Doijode, 1990) reported that fresh seeds remain viable for four to five weeks under ambient conditions. Parisot (1989) explained that loss of water from stored seeds and loss of germination capacity were rapid at high storage temperature (20 to 30°C). Retention of high moisture during storage promotes fungal growth, which causes discoloration and loss of viability. High moisture also stimulates the sprouting of seeds during ambient storage. Storing fruits at low temperature causes chilling injury. According to Simao (1959), the best method is to store whole fruit at room temperature (22 to 25°C), allowing seeds to remain viable for 70 days. Storage at 5°C harms the fruit. Seeds stored with the bulb were also found to be highly

susceptible to fungal attack which could be one of the reasons for poor germination of the seeds. Earlier studies suggest that jack seeds can be preserved in fruit for 32 days with 58% germination and 72 days with 6% germination following fungicidal treatment (Dundaiah., *et. al.*, 1992). Storage of Litchi chinensis fruits was found to retain the seed viability for 24 days in sealed polyethylene bags after treatment with the fungicide Benomyl (0.05%) and 6% wax emulsion (Ray. and Sharma 1987). The seeds do not withstand drying or are unable to survive low temperatures during storage. Thus, they are difficult to store for longer period Ellis (1984), Hanson (1984). The exact causes of recalcitrant seed death and its relationship with moisture content are not fully understood (Fu., Xia and Tang 1993). Death of recalcitrant seeds due to loss of moisture is mainly attributed to the loss of membrane integrity and nuclear disintegration (Chin 1995). Simon (2007) reported that more research work is needed to determine proper handling and storage of tree seeds, especially recalcitrant seeds which are difficult to store. Little information is available in the aspect of storage of mango seed stone within fruit, so the current study was attempted to furnish some information on mango seed storage especially within fruit.

**Material and methods:** Two mango cultivars (Alphonse and Dr.Knight) were used for this study. One hundred and sixty firm ripe fruit were selected from each cultivar based on the uniformity of their size and color. These fruits were washed and divided into two groups. The first one (contained 80 fruits) was stored in a refrigerator (Refri.). The second group contained the same number of fruit and was stored at room temperature (room temp.). Seeds extracted from fruits and sown at intervals of 2, 4, 8 and 12 weeks. Eighty seed stones from two cultivars were laid out in a completely randomize design with 4 replicates; each replicates contained two plots with 10 seed stones each. Sowing was performed by planting the seed stones in small polyethylene gags 14x20 cm contain soil mixture of river silt and sand at a ratio of 2:1 (by volume). All bags received similar cultural care. Seed stones were immediately irrigated then daily until the emergence of seedlings then irrigated was done twice a week. After the emergence of first seedling, the counting was carried out at weekly intervals until germination was complete. The parameters recorded were germination percentage, fresh weight and number of days required for emergence of mango seedlings.

**Result:** The results show that, storage duration and storage temperature had significant effect on germination percentage. Storage of seed stone within fruits for 2 weeks was better than 4 weeks in germination percentage and fresh weight Table (1) and Table (2). At 8 and 12 weeks seed stones stored within fruit failed to germinate. Higher fresh weight was resulted from 2 weeks than other duration Table (3). Room temperature was better than refrigerator in germination percentage where only 62% and 60% was recorded for Alphonso and Dr. knight respectively after 4 weeks at room temperature while 20% of germination percentage was recorded for both cultivars at refrigerator after 4 weeks intervals Table (4) but refrigerator was better in fresh weight of seed and Alphonso was better than Dr.knight in seed stone fresh weight Table (5).

These results were in agreement with those obtained by Chin (1988) who found that storage of seed within fruits or fruit juice was generally unsuccessful. On other hand recalcitrant seeds are sensitive to desiccation and freezing (Berjak and Pammenter 2004; McDonald 2004). Ito and Atubra (1973) noted that seed could be kept in dry storage for over month. This may be due to inhibitor substance which prevents germination inside the fruit beside the character of recalcitrant seeds which had low storability (Chin 1978). Also Chin (1995) explained that death

of recalcitrant seeds due to loss of moisture is mainly attributed to the loss of membrane integrity and nuclear disintegration.

**Table(1): Effect of storage of mango seed stones within fruits and the interaction between duration and storage condition on germination percentage of cultivar Alphonso seed only.**

Storage duration	Room temp,	Refrigerator	Duration mean
2 weeks	30.0 <sup>a</sup>	5.0 <sup>b</sup>	17.5 <sup>a</sup>
4 weeks	0.0 <sup>b</sup>	5.0 <sup>b</sup>	2.5 <sup>b</sup>
Condition mean	15.0	5.0	

Means within rows\ row followed by the same letters are not significantly different at 0.05 level of probability according to Duncan's multiple range test (DMRT).

**Table (2): Mean squares for the effect storage mango seed stones within fruits at 2 storage temperatures for 4 different duration on fresh weight of seeds of two mango cultivars Alphonso and Dr. Knight Season 2000/2001.**

Source of variation	d.f.	Fresh weight
Total	63	
Cultivars	1	66.9 **
Storage temperature	1	94.9 **
Storage duration	3	272.1 **
Cultivar X temperature	1	11.7 **
Cultivar X duration	3	10.1 **
Temperature X duration	3	2.7 **
Cultivars X temp. X duration	3	58.9 **
Error	48	1.7

\*Significant at 0.05 level of probability. \*\* Significant at 0.01 level of probability.

Ns: Not significant.

**Table (3): Effect of interaction between cultivars, storage condition and storage duration on fresh weight of mango seed stones of two mango cultivars Alphonso and Dr. knight Season 2000/2001.**

Cultivars	Storage condition	2 weeks	4 weeks	8 weeks	12 weeks	Condition mean
Alphonso	Refri.	22.4 <sup>ab*z</sup>	21.7 <sup>abc</sup>	21.8 <sup>abc</sup>	14.4 <sup>e</sup>	20.1 <sup>a*y</sup>
	Room temp.	24.5 <sup>a</sup>	18.5 <sup>c</sup>	12.8 <sup>e</sup>	11.3 <sup>e</sup>	16.8 <sup>b</sup>
Dr. Knight	Refri.	23.3 <sup>a</sup>	19.1 <sup>bc</sup>	12.1 <sup>e</sup>	14.2 <sup>e</sup>	17.2 <sup>b</sup>
	Room temp.	18.3 <sup>c</sup>	18.0 <sup>cd</sup>	14.7 <sup>de</sup>	11.2 <sup>e</sup>	15.6 <sup>c</sup>
Duration mean		22.1 <sup>a*z</sup>	19.3 <sup>b</sup>	15.3 <sup>c</sup>	12.8 <sup>d</sup>	

\*y Means of column followed by the same letters are not significantly different at 0.05 level of probability according to Duncan's multiple range test(DMRT).

\*z means within rows\ row followed by the same letters are not significantly different at 0.05 level of probability according to Duncan's multiple range test (DMRT)

**Table (4): Effect of the interaction between storage condition and storage duration on germination percentage of mango seed stone of two mango cultivar season 2000/2001.**

Cultivars	Storage duration	Room temperature	Refrigerator	Duration mean	Cultivars mean
Alphonso	2 weeks	45.0 <sup>c*z</sup>	20.0 <sup>e</sup>	62.0	41.3
	4 weeks	90.0 <sup>a</sup>	20.0 <sup>e</sup>	20.0	
Dr,Knight	2 weeks	80.0 <sup>b</sup>	20.0 <sup>c</sup>	60.0	40.0
	4 weeks	30.0 <sup>d</sup>	20.0 <sup>e</sup>	20.0	
Condition mean		43.8 <sup>a</sup>	37.5 <sup>b</sup>		

Means within rows\ row followed by the same letters are not significantly different at 0.05 level of probability according to Duncan's multiple range test (DMRT).

**Table (5): Effect of storage condition on fresh weight of mango seed stones of two mango cultivars. Season 2000/2001.**

Cultivars	Room temp.	Refrigerator	Cultivars mean
Alphonso	16.8 <sup>b *z</sup>	20.1 <sup>a</sup>	18.4 <sup>a *y</sup>
Dr. Knight	15.7 <sup>c</sup>	17.2 <sup>b</sup>	16.4 <sup>b</sup>
Condition mean	16.2 <sup>b</sup>	18.6 <sup>a</sup>	

\*y Means of column followed by the same letters are not significantly different at 0.05 level of probability according to Duncan's multiple range test (DMRT).

\*z means within rows\ row followed by the same letters are not significantly different at 0.05 level of probability according to Duncan's multiple range test (DMRT)

### Conclusion

Under this study we evaluate the effect of storage of mango seed stone within fruit of 2 different mango cultivars at 2 storage temperature for 4 different durations. From the experiment result 2 weeks was better than others duration, at 8 and 12 weeks seeds failed to germinate. Room temperature was also better than refrigerator but cultivars have no significant effect on germination percentage but had significant effect on seed stone fresh weight. Based on this study storage of mango seed stone within mango fruit was generally unsuccessful especially for long period.

### Reference

- Berjak P, Pammenter NW (2004). Recalcitrant seeds. In: Benech-Arnold RL, Sánchez RA (Eds) *Handbook of Seed Physiology, Application to Agriculture*, The Haworth Press, Inc, NY, USA, pp 305-345.
- Chin , H. F.(1978). Production and storage of recalcitrant seeds in the tropics. *Acta Hort.*83:17-21.
- Chin, H. F. (1988). Recalcitrant Seeds. *Astatus report*. International Board for plant Genetic resources, Rome. PP 8-11.
- Chin H. F. (1995). Storage of recalcitrant seeds. In: Basra AS (Ed) *Seed Quality Basic Mechanisms and Agriculture Implications*, The Haworth Press, Inc. NY, USA, pp 209-222
- Doijode, S.D. 1990. Influence of seed moisture on longevity of mango seeds. *Proc. Inter. Sat. Symp. Seed Sci. Technol.* Hisar, pp. 93-96.
- Dundaiah M., Venkatesh D.A. and Mahadevamurthy S. 1992. Germination at high moisture content in jack fruit (*Artocarpus integra* Thunb. Merrill) seeds. *My Forest.* 28(1): 8-10.
- Ellis R. H. 1984. Revised table of seed storage characteristics. *Plant Genetics News L.* 58: 16-33.
- Fu J. R., Xia Q. H. and Tang L. F. 1993. Effects of desiccation on excised embryonic axes of three recalcitrant seeds and studies on cryopreservation. *Seed Science and Technology.* 21: 85-95.
- Giri, A., (1966). Germination percentage, average, height and girth of seedling raised from seed stones extracted from syrupy and firm mango fruit.

- Pakistan. J. of Science Vol.18. (3\4): 79-81.
- Hanson J. 1984. The storage of seeds of tropical fruit trees. In: Crop Genetic Resources: Conservation and Evaluation (J. H. W. Holden and J. T. Williams, Eds.). George Allen and Unwin, London. pp. 53-62.
- Ito. P. J. and Atubra O. K. (1973). Mango seed storage and propagation. University of Science and Technol. Kumasi . Chana farmer. 17(1)34-38.
- Food and Agricultural Organization (FAO), (2003). World Agricultural Center Database. Consulted on 13 Feb 2003, <[http://www.fao.org/waicent/portal/statistic\\_en.asp](http://www.fao.org/waicent/portal/statistic_en.asp)> .
- McDonald MB (2004) Orthodox seed deterioration and its repair. In: Benech- Arnold RL, Sánchez RA (Eds) *Handbook of Seed Physiology, Application to Agriculture*, Haworth Press, Inc, NY, USA, pp 273-298.
- Parisot, E. (1989). Study of the growth rhythm in young mango (*Mangifera indica* L.). Part I. Description, germination and storage of polyembryonic mango seeds. *Fruits* 43:97-105.
- Ray P. K. and Sharma S. B. 1987. Growth, maturity, germination and storage of Litchi seeds. *Scientia Hort.* 33: 213-221.
- Shant. P. S. and Saproo, B. L. (1974). Effect of variation stages of fruit maturity and different levels of pulp extraction on germination of mango stones. *Bangladesh . Horticulture* 2 (2): 49-50.
- Simao, S. 1959. A study of the germinating power of mango seeds. *An. Esc. Sup.*
- Singh, L.B. 1960. The mango—Botany, cultivation and utilization. London: Leonard Hill Book Company